Terrestrial Gravity Measurements towards Turkish Height System Modernization

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One of the key components of the Turkish height system modernization project is the determination of high resolution regional gravity field from terrestrial and satellite measurements. Terrestrial gravity data in Turkey have been collected by different organizations over many decades. Although the density of these data is sufficient in most part of the country, the poor quality mainly due to the inconsistent coordinate and gravity reference frames prevented us to compute a gravimetric geoid model of a few cm accuracy. Therefore, we are now working on the elimination of discrepancies between these historical datasets, developing a national gravity database and preparing guidelines for measuring, reducing, processing and exchanging terrestrial gravity data. In the meantime, new field campaigns were started in 2011 to extend the national gravity standardization network and to increase the amount of control points to be used for the quality check of the historical data. This study describes the (i) recent relative gravity and vertical gravity gradient measurements, (ii) numerical investigations on the standard reductions due to Earth tides, polar motion, instrumental height and air pressure variations, (iii) applied adjustment models and adjustment results. Preliminary results show that differences between using Longman formula adopted in Scintrex CG3 and CG5 instruments and the specific tide catalogues (e.g. Cartwright-Tayler, Tamura) with approximate amplitude and phase-difference values for the main tide wave groups never exceed 5 μGal. Maximum reduction for the pole motion is about 2 μGal. The variations in atmospheric pressure lead to a maximum reduction of about 5 μGal. Vertical gravity gradient values determined at 98 sites are in the range of -0.2078 to -0.4357 mgal/m with a mean of -0.2995 mgal/m that is about 9 μGal/m different from the theoretical value.